# Research Note

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## SITE INDEX CHANGES IN WESTERN WHITE PINE FORESTS

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Does site index change over a period of years? If so, does it change enough to have any appreciable effect upon management? Twenty-year records from 88 permanent sample plots in uncut second-growth stands of western white pine show that for this species and for this period, at least, site changes have been small.

The determination of growth capacity of forest land is fundamental to many decisions that must be made by the forester. For example, knowledge of site quality is important in choosing species to plant, estimating yields, determining goals and intensity of cultural operations, and selecting reproduction systems. Although lesser vegetation and physical qualities of the soil have been used in some instances to judge site quality, foresters in the western white pine type depend upon height and age data[1/] to arrive at a numerical rating of site (the site index).

Standard graphical methods with accompanying statistical checks were used originally by Haig[1/] to analyze height-age relationships on over 300 plots for construction of western white pine yield tables. If this concept of determining site quality is faulty, the use of yield table volume estimates is subject to error also. The study reported here deals with the site index changes which have occurred on permanent sample plots in the western white pine type. The results should be of widespread interest since they involve a basic concept of site index curve construction and use evaluated by an analysis of long-time plot records.

### METHODS AND RESULTS OF ANALYSES

Records from 88 permanent plots in uncut second-growth stands are the basis of this study. The plots were remeasured every five years. The measurements included sufficient height-diameter data to give a reliable height curve for white pine from which site indices were calculated using the site index charts of Haig's bulletin. Site index changes for 324 five-year periods were available for analysis.

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1/ Haig, I. T. Second growth yield, stand, and volume tables for the western white pine type. USDA Tech. Bul. 323. 1932.

Multiple regression analysis was used to determine the influence of density (percentage of normal basal area), age, site index, and composition index (percentage of stand composed of western white pine and grand fir) upon the five-year change in site index. Density and composition index were not significant factors; age was significant at the five-percent level and site index at the one-percent level. Site index at the beginning of the five-year period accounted for most of the change. Average five-year changes in site index are given in table 1.

Table 1. Average site index changes on permanent sample plots

| Site index class (Feet) | 5-year change | | | 20-year change | | |
|---|---|---|---|---|---|---|
| | Change | Standard deviation | Observations | Change | Standard deviation | Observations |
| | Feet | Feet | Number | Feet | Feet | Number |
| Less than 46 | + 0.78 | ± 2.32 | 78 | + 3.11 | ± 4.00 | 18 |
| 46 - 55 | + 0.53 | ± 2.50 | 73 | + 2.43 | ± 2.41 | 14 |
| 56 - 65 | - 0.04 | ± 2.62 | 102 | + 0.80 | ± 3.99 | 15 |
| 66 - 75 | - 0.53 | ± 2.29 | 60 | - 2.36 | ± 3.19 | 14 |
| More than 75 | - 1.45 | ± 2.68 | 11 | | | |

An analysis of 61 twenty-year changes showed that site index at the start of the period was the only significant variable affecting site index changes. The average twenty-year change by site index classes is also shown in table 1.

## CONCLUSIONS

Only small changes in site index have occurred on 88 permanent sample plots in the western white pine type. As shown by the magnitude of standard deviations (table 1) the plot data exhibited considerable variation. Some of this variation may have resulted from erratic changes in site index caused by methods of measurement used by the many different field parties over a period of 25 years. However, the changes in site index cannot be charged in very great part to errors in field work, nor can they be explained by recorded changes in soil and climate. Slight errors in the curves used for determining site index are the most logical explanation. In any event, the changes in site index are so small that site index values currently in use are sufficiently accurate for application to second-growth western white pine stands.